EXECUTIVE SUMMARY

Thank you for your continued hard work sampling **Mascoma Lake** this year! Your monitoring group sampled the deep spot **three** times this year and has done so for many years. As you know, conducting multiple sampling events each year enables DES to more accurately detect water quality changes. Keep up the great work!

We encourage your monitoring group to continue utilizing the Colby Sawyer College Water Quality Laboratory in New London. This laboratory was established to serve the large number of lakes/ponds in the greater Lake Sunapee region of the state. This laboratory is inspected by DES and operates under a DES approved quality assurance plan. We encourage your monitoring group to utilize this laboratory next summer for all sampling events, except for the annual DES biologist visit. To find out more about the Colby Sawyer College Water Quality Laboratory, and/or to schedule dates to pick up bottles and equipment, please call Bonnie Lewis, laboratory manager, at (603) 526-3486.

Volunteers from your lake participated in the Lake Host™ Program this year. The Lake Host™ Program is funded through DES and Federal grants. The program was developed in 2002 by NH LAKES and NHDES to educate and prevent boaters from spreading exotic aquatic plants to lakes and ponds in New Hampshire. Since then, the number of participating lakes and ponds and volunteers has doubled, the number of boats inspected has tripled, and the number of “saves” (exotic plants discovered) has increased from four in 2002 to a total of 297 in 2009. The program is invaluable in educating boaters and protecting NH’s waterbodies from exotic aquatic plant infestations, thereby preventing recreational hazards, property value decline, aquatic ecosystem decline, aesthetic issues, and saving costly remediation efforts. Lake Host™ staff discovered the following aquatic vegetation entering or leaving your lake in 2009:

Milfoil Spp. (native)
Spike rush (native)

Great work! We encourage volunteers to continue participating in the Lake Host™ Program to protect the future of your lake.

OBSERVATIONS & RECOMMENDATIONS

DEEP SPOT

➢ Chlorophyll-a

Chlorophyll-a, a pigment found in plants, is an indicator of algal or cyanobacteria abundance. Algae are typically microscopic plants that are naturally found in the lake ecosystem. The measurement of chlorophyll-a in the water gives biologists an estimation of the algal concentration or lake productivity. Table 14 in Appendix A lists the current year chlorophyll-a data.

Figure 1 depicts the historical and current year chlorophyll-a concentration in the water column.

The median summer chlorophyll-a concentration for New Hampshire's lakes and ponds is 4.58 mg/m^3.

STATION 1
The current year data (the top graph) show that the chlorophyll-a concentration ***increased*** from **July** to **August**. The **June** chlorophyll-a sample was deemed invalid. The original sample value did not meet the Relative Percent Difference of < 20% of the duplicate sample value.

The historical data (the bottom graph) show that the **2009** chlorophyll-a mean is ***less than*** the state median and is ***slightly less than*** the similar lake median. For more information on the similar lake median, refer to Appendix D.

Overall, visual inspection of the historical data trend line (the bottom graph) shows a ***variable*** in-lake chlorophyll-a trend since monitoring began. Specifically the mean chlorophyll concentration has ***fluctuated between approximately 1.87 and 5.56 mg/m^3*** since **1991**.

STATION 2
The current year data (the top graph) show that the chlorophyll-a concentration ***increased*** from **June** to **August**.

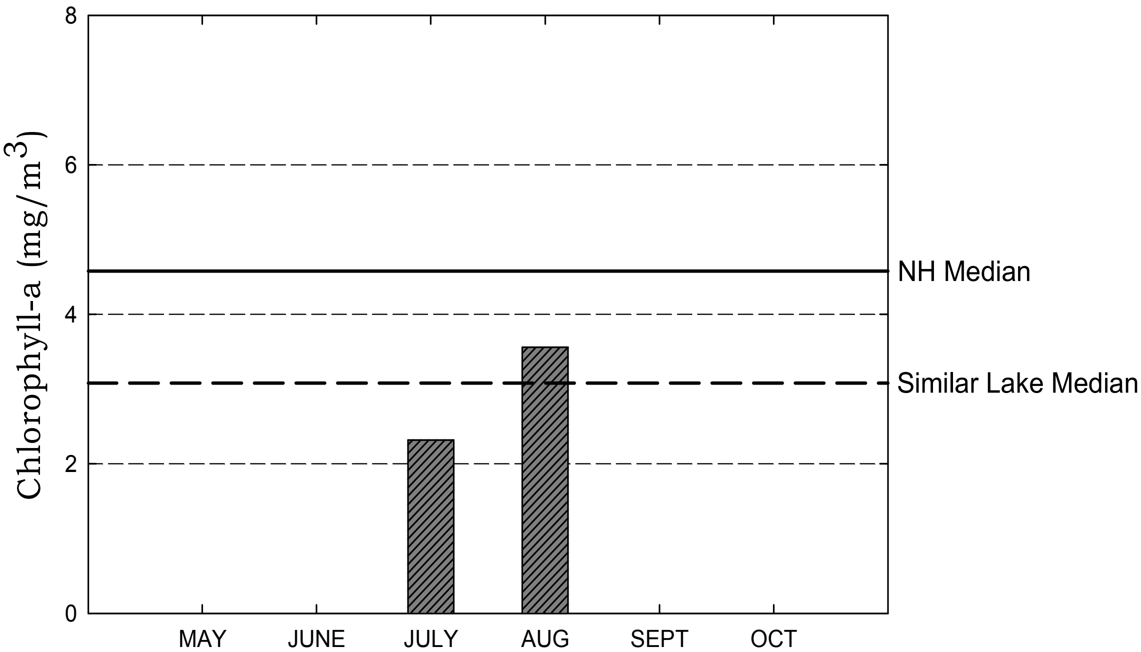
The historical data (the bottom graph) show that the **2009** chlorophyll-a mean is ***slightly less than*** the state median and is ***slightly greater than*** the similar lake median. For more information on the similar lake median, refer to Appendix D.

Overall, visual inspection of the historical data trend line (the bottom graph) shows a ***variable*** in-lake chlorophyll-a trend since monitoring began. Specifically the mean chlorophyll concentration has ***fluctuated between approximately 2.58 and 6.59 mg/m^3*** since **1991**.

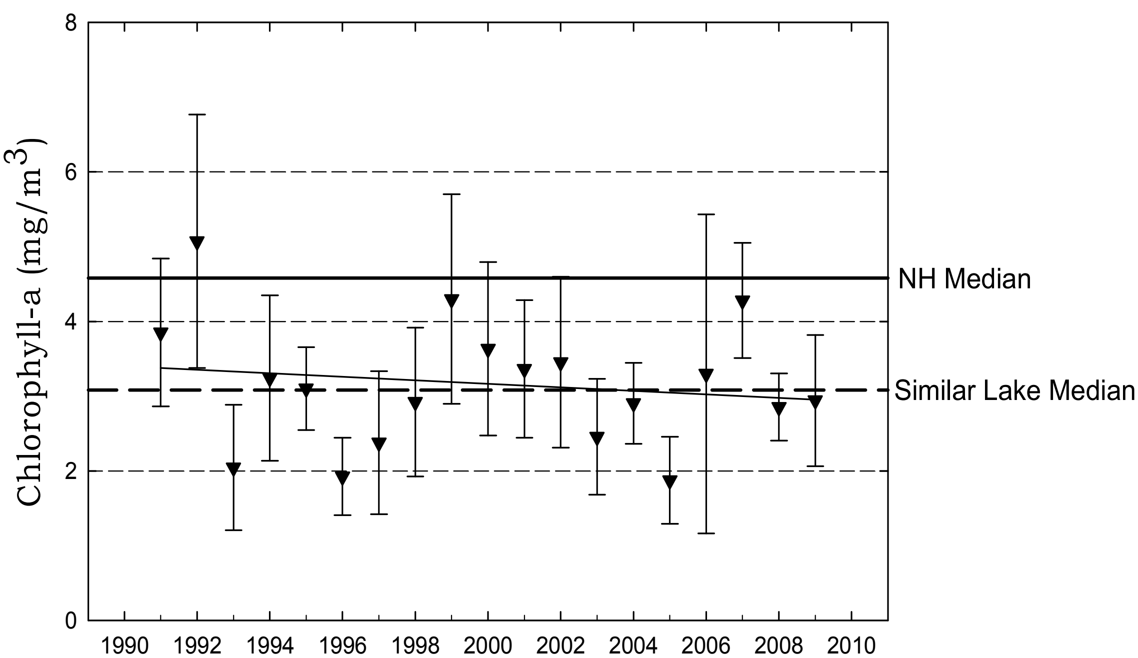
While algae are naturally present in all waterbodies, an excessive or increasing amount of any type is not welcomed. Phosphorus is the nutrient that algae typically depend upon for growth in New Hampshire lakes and ponds. Algal concentrations increase as nonpoint sources of phosphorus from the watershed increase, or as in-lake phosphorus sources increase. Increased Chlorophyll-a concentrations can also affect water clarity, causing Secchi-disk transparency to decrease (worsen) and turbidity to increase (worsen). Therefore, it is extremely important for volunteer monitors to continually educate all watershed residents about management practices that can be implemented to minimize phosphorus loading to surface waters.

Mascoma Lake, Stn. 1, Enfield

Figure 1. Monthly and Historical Chlorophyll-a Results



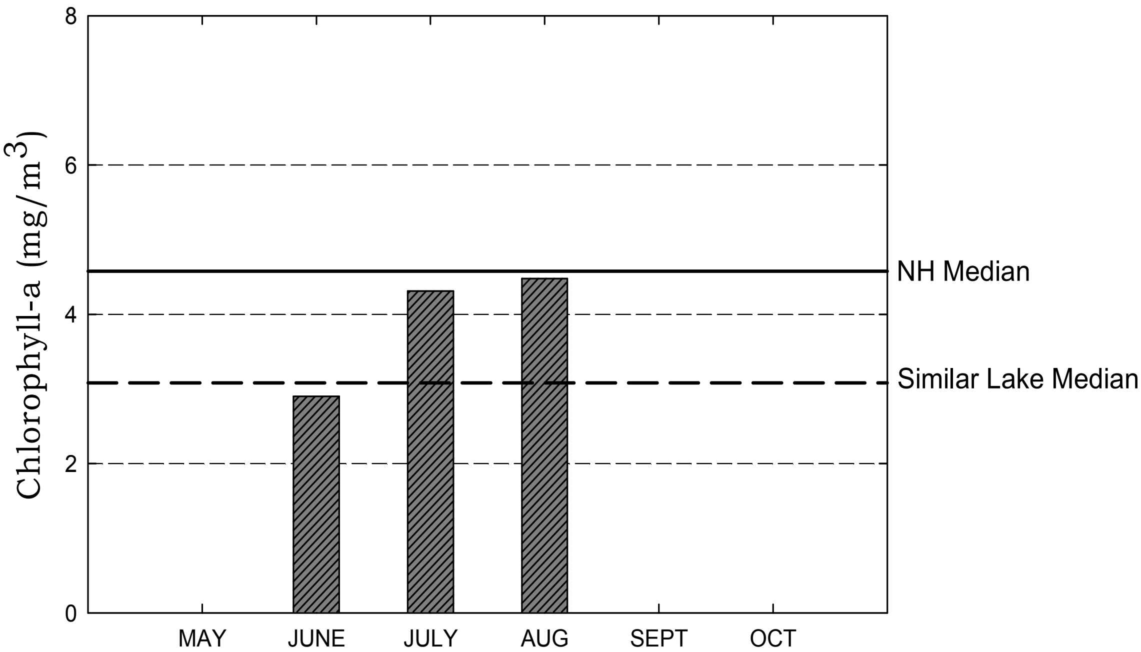
2009 Chlorophyll-a Results



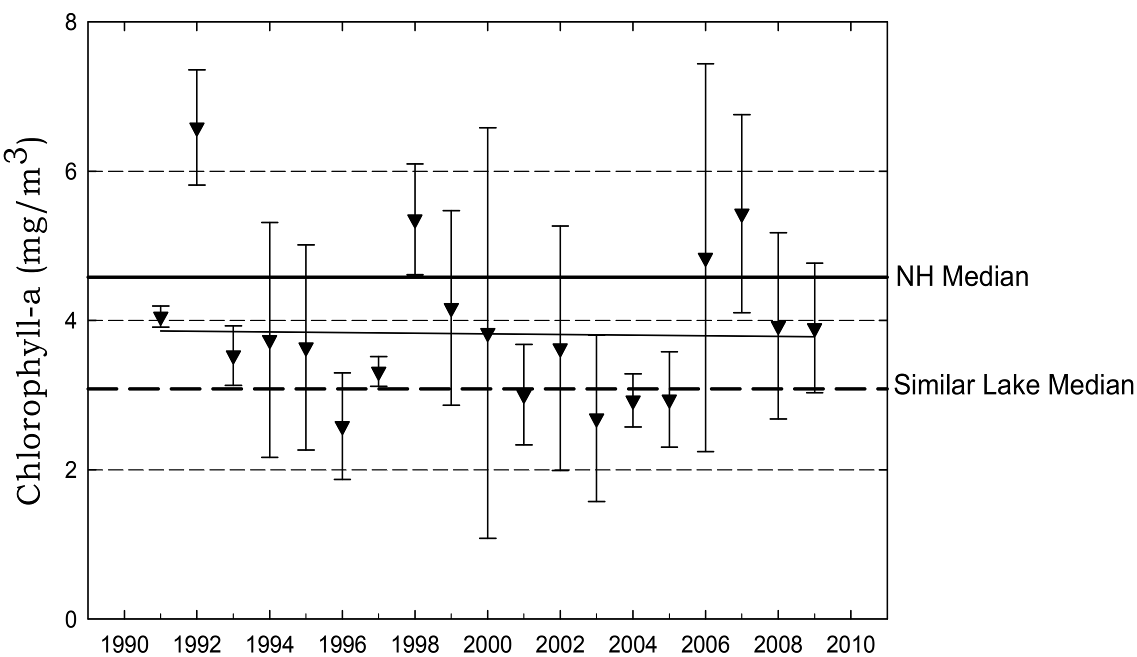
Historical Chlorophyll-a Results

Mascoma Lake, Stn. 2, Enfield

Figure 1. Monthly and Historical Chlorophyll-a Results



2009 Chlorophyll-a Results



Historical Chlorophyll-a Results

➢ Phytoplankton and Cyanobacteria

Table 1 lists the phytoplankton (algae) and/or cyanobacteria observed in the pond in **2009**. Specifically, this table lists the three most dominant phytoplankton and/or cyanobacteria observed and their relative dominance in the sample.

Table 1. Dominant Phytoplankton/Cyanobacteria (June 2009)

Station	Division	Genus	% Dominance
Station 1	Cyanophyta	Anabaena	54.6
Station 1	Chrysophyta	Dinobryon	15.1
Station 1	Chrysophyta	Mallomonas	10.0
Station 2	Cyanophyta	Anabaena	36.5
Station 2	Chrysophyta	Mallomonas	16.2
Station 2	Chrysophyta	Dinobryon	13.0

Phytoplankton populations undergo a natural succession during the growing season. Please refer to the "Biological Monitoring Parameters" section of this report for a more detailed explanation regarding seasonal plankton succession. Diatoms and golden-brown algae populations are typical in New Hampshire's less productive lakes and ponds.

The cyanobacterium ***Anabaena*** was observed in the **June** plankton sample. ***This cyanobacteria, if present in large amounts, can be toxic to livestock, wildlife, pets, and humans.*** Please refer to the "Biological Monitoring Parameters" section of this report for a more detailed explanation regarding cyanobacteria.

Also, a cyanobacteria bloom occurred in the pond in **June** and **August**. Samples were collected and returned to the DES Limnology Center for analysis. A **lake warning** was issued on **6/10/2009** notifying the public of the presence of potentially toxic cyanobacteria. The cyanobacteria were identified as ***Anabaena,*** potentially toxic cyanobacteria. Samples were collected regularly throughout the warning period and the warning was removed on **6/17/2009** after cyanobacteria concentrations decreased to acceptable levels. A **beach advisory** was issued on **8/12/2009** notifying beach users of the presence of potentially toxic cyanobacteria. The cyanobacteria were identified as ***Anabaena***, potentially toxic cyanobacteria. Samples were collected regularly during the advisory period and the advisory was removed on **8/15/2009**.

Cyanobacteria can reach nuisance levels when phosphorus loading from the watershed to surface waters is increased and favorable environmental conditions occur, such as a period of sunny, warm weather.

The presence of cyanobacteria serves as a reminder of the pond's delicate balance. Watershed residents should continue to act proactively to reduce nutrient loading to the pond by eliminating fertilizer use on lawns, keeping the pond shoreline natural, re-vegetating cleared areas within the watershed, and properly maintaining septic systems and roads.

In addition, residents should also observe the pond in September and October during the time of fall turnover (lake mixing) to document any algal blooms that may occur. Cyanobacteria have the ability to regulate their depth in the water column by producing or releasing gas from vesicles. However, occasionally lake mixing can affect their buoyancy and cause them to rise to the surface and bloom. Wind and currents tend to "pile" cyanobacteria into scums that accumulate in one section of the pond. If a fall bloom occurs, please collect a sample in any clean jar or bottle and contact the VLAP Coordinator.

➢ Secchi Disk Transparency

Volunteer monitors use the Secchi disk, a 20 cm disk with alternating black and white quadrants, to measure how far a person can see into the water. Transparency, a measure of water clarity, can be affected by the amount of algae and sediment in the water, as well as the natural color of the water. Table 14 in Appendix A lists the current year transparency data. **The median summer transparency for New Hampshire's lakes and ponds is 3.2 meters.**

Figure 2 depicts the historical and current year transparency ***with and without*** the use of a viewscope.

STATION 1
The current year ***non-viewscope*** in-lake transparency ***increased*** from **June** to **July**, and then ***decreased*** from **July** to **August**.

It is important to note that as the chlorophyll ***increased*** from **July** to **August**, the transparency ***decreased***. We typically expect this ***inverse*** relationship in lakes. As the amount of algal cells in the water increases, the depth to which one can see into the water column typically decreases, and vice-versa.

The current year ***viewscope*** in-lake transparency ***increased*** from **June** to **July** and then ***decreased*** from **July** to **August**.

The transparency measured with the viewscope was generally ***greater than*** the transparency measured without the viewscope this summer. A comparison of the transparency readings taken with and without the use of a viewscope shows that the viewscope typically increases the depth to which the Secchi disk can be seen into the lake, particularly on sunny and windy days. We recommend that your group measure Secchi disk transparency with and without the viewscope on each sampling event.

It is important to note that viewscope transparency data are not compared to a New Hampshire median or similar lake median. This is because lake transparency with the use of a viewscope has not been historically measured by

DES. In the future, the New Hampshire and similar lake medians for viewscope transparency will be calculated and added to the appropriate graphs.

The historical data (the bottom graph) show that the **2009** mean non-viewscope transparency is ***slightly less than*** the state median and is ***much less than*** the similar lake median. Please refer to Appendix D for more information about the similar lake median.

Visual inspection of the historical data trend line (the bottom graph) shows a ***decreasing*** trend, meaning that the transparency has ***worsened*** since monitoring began in **1991**.

STATION 2

The current year ***non-viewscope*** in-lake transparency ***increased*** from **June** to **August**.

The current year ***viewscope*** in-lake transparency ***decreased*** from **June** to **July** and then ***increased*** from **July** to **August**.

The transparency measured with the viewscope was generally ***greater than*** the transparency measured without the viewscope this summer. A comparison of the transparency readings taken with and without the use of a viewscope shows that the viewscope typically increases the depth to which the Secchi disk can be seen into the lake, particularly on sunny and windy days. We recommend that your group measure Secchi disk transparency with and without the viewscope on each sampling event.

It is important to note that viewscope transparency data are not compared to a New Hampshire median or similar lake median. This is because lake transparency with the use of a viewscope has not been historically measured by DES. In the future, the New Hampshire and similar lake medians for viewscope transparency will be calculated and added to the appropriate graphs.

The historical data (the bottom graph) show that the **2009** mean non-viewscope transparency is ***slightly less than*** the state median and is ***much less than*** the similar lake median. Please refer to Appendix D for more information about the similar lake median.

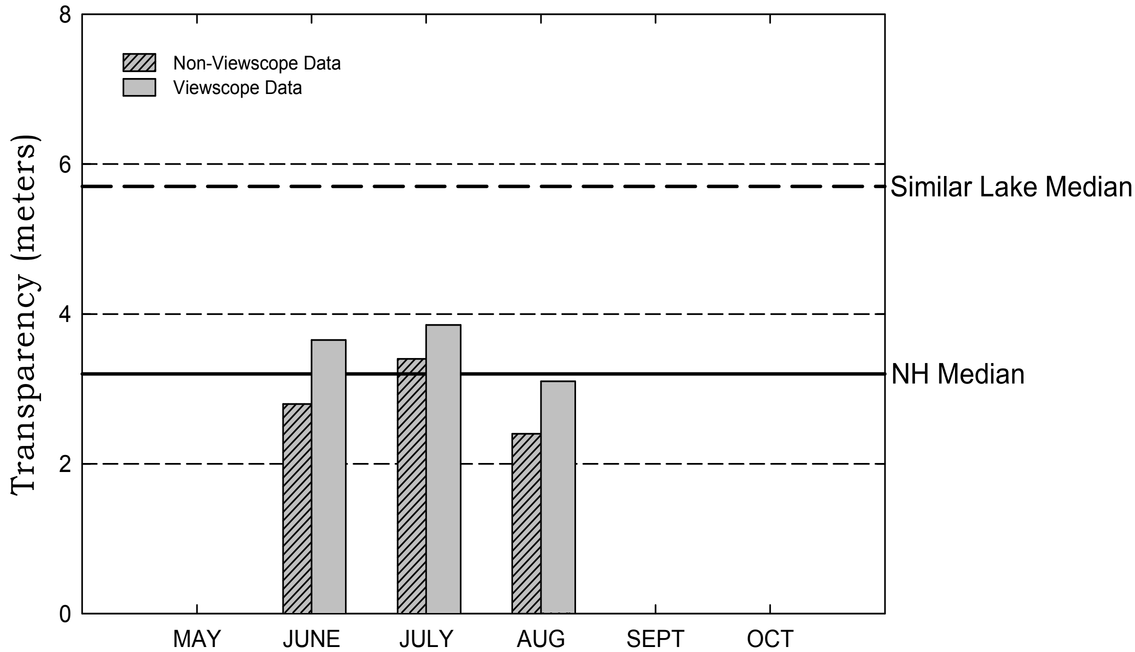
Visual inspection of the historical data trend line (the bottom graph) shows a ***decreasing*** trend, meaning that the transparency has ***worsened*** since monitoring began in **1991**.

Typically, high intensity rainfall causes sediment-laden stormwater runoff to flow into surface waters, thus increasing turbidity and decreasing clarity. Efforts should continually be made to stabilize stream banks, pond shorelines, disturbed soils within the watershed, and especially dirt roads located immediately adjacent to the edge of tributaries and the pond. Guides to best management practices that can be implemented to reduce, and possibly even eliminate, nonpoint source pollutants, are available from DES upon request.

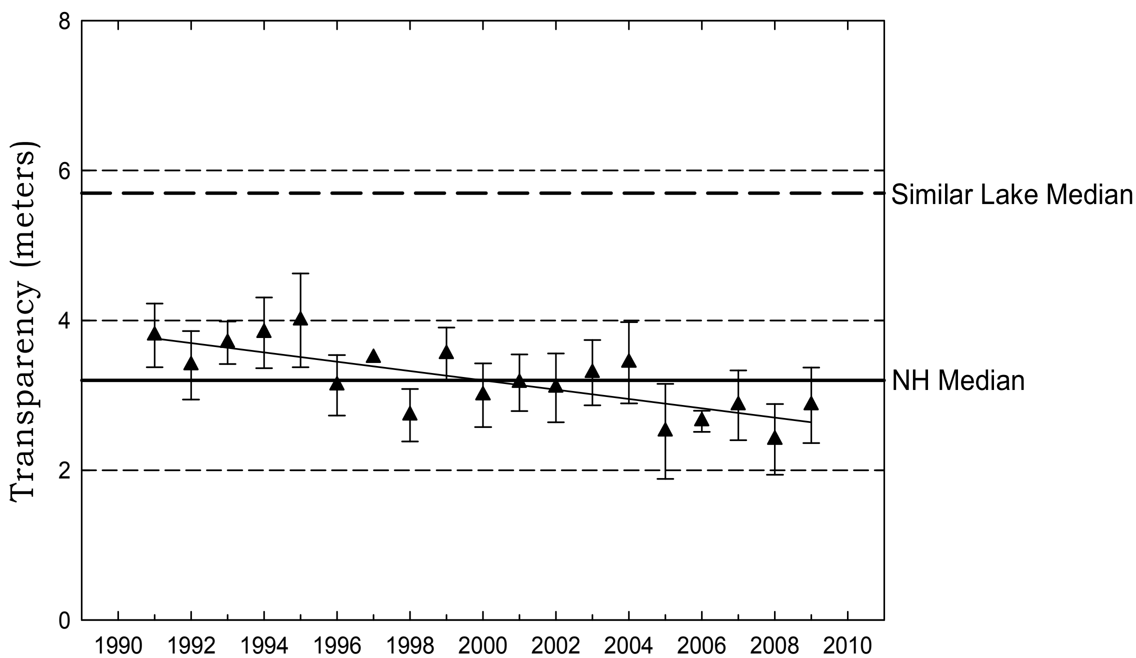
We recommend that your group continue to measure the transparency with and without the use of the viewscope on each sampling event. Ultimately, we would like all monitoring groups to use a viewscope to take Secchi disk readings as the use of the viewscope results in less variability in transparency readings between monitors and sampling events. At some point in the future, when we have sufficient data to determine a statistical relationship between transparency readings collected with and without the use of a viewscope, it may only be necessary to collect transparency readings with the use of a viewscope.

Mascoma Lake, Stn.1, Enfield

Figure 2. Monthly and Historical Transparency Results



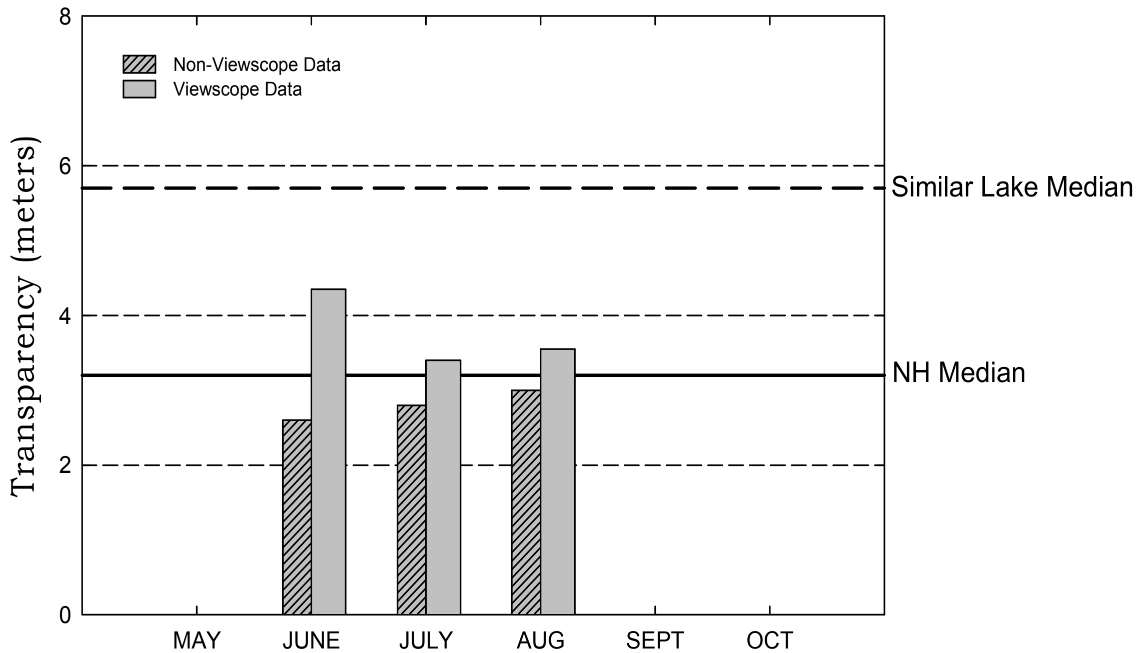
2009 Transparency Viewscope and Non-Viewscope Results



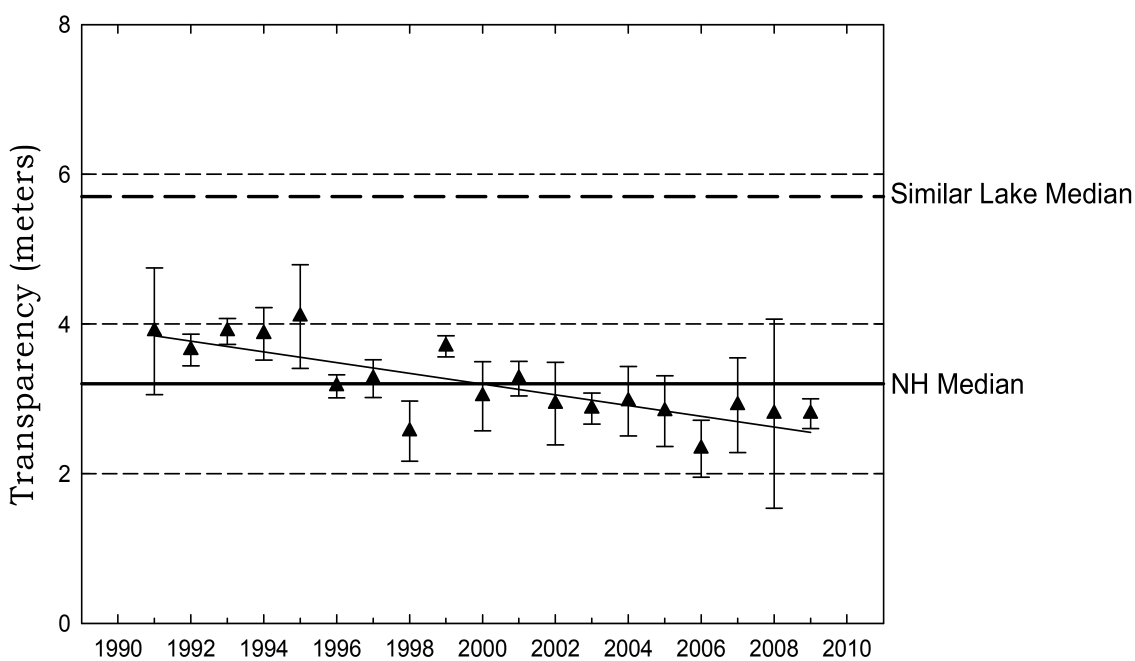
Historical Transparency Non-Viewscope Results

Mascoma Lake, Stn.2, Enfield

Figure 2. Monthly and Historical Transparency Results



2009 Transparency Viewscope and Non-Viewscope Results



Historical Transparency Non-Viewscope Results

➢ Total Phosphorus

Phosphorus is typically the limiting nutrient for vascular plant and algae growth in New Hampshire's lakes and ponds. Excessive phosphorus in a pond can lead to increased plant and algal growth over time. Table 14 in Appendix A lists the current year total phosphorus data for in-lake and tributary stations. **The median summer total phosphorus concentration in the epilimnion (upper layer) of New Hampshire's lakes and ponds is 12 ug/L. The median summer phosphorus concentration in the hypolimnion (lower layer) is 14 ug/L.**

The graphs in Figure 3 depict the historical amount of epilimnetic (upper layer) and hypolimnetic (lower layer) total phosphorus concentrations; the inset graphs depict current year total phosphorus data.

STATION 1
The current year data for the epilimnion (the top inset graph) show that the phosphorus concentration ***decreased*** from **June** to **July**, and then ***increased*** from **July** to **August**.

The ***slightly elevated*** epilimnetic phosphorus concentration measured on the **June** sampling event may have been due to phosphorus-enriched stormwater runoff that flowed into the surface layer of the lake. Weather records indicate that approximately **1.5 inches** of rainfall was measured **24-72 hours** prior to sampling.

The historical data show that the **2009** mean epilimnetic phosphorus concentration is ***slightly less than*** the state median and is ***slightly greater than*** the similar lake median. Refer to Appendix D for more information about the similar lake median.

The current year data for the hypolimnion (the bottom inset graph) show that the phosphorus concentration ***decreased*** from **June** to **July**, and then ***increased*** from **July** to **August**.

The historical data show that the **2009** mean hypolimnetic phosphorus concentration is ***slightly greater than*** the state and similar lake medians. Please refer to Appendix D for more information about the similar lake median.

Overall, visual inspection of the epilimnetic historical data trend line shows an ***increasing*** phosphorus trend. Specifically, the mean annual epilimnetic phosphorus concentration has ***worsened*** since monitoring began in **1991**.

Overall, visual inspection of the hypolimnetic historical data trend line shows a ***variable*** phosphorus trend since monitoring began. Specifically the mean annual concentration has ***fluctuated between approximately 11 and 26 ug/L*** since monitoring began in **1991** (excluding 2003 mean hypolimnetic phosphorus concentration).

STATION 2
The current year data for the epilimnion (the top inset graph) show that the phosphorus concentration ***decreased slightly*** from **June** to **July**, and then ***increased slightly*** from **July** to **August**.

The historical data show that the **2009** mean epilimnetic phosphorus concentration is ***approximately equal to*** the state median and is ***slightly greater than*** the similar lake median. Refer to Appendix D for more information about the similar lake median.

The current year data for the hypolimnion (the bottom inset graph) show that the phosphorus concentration ***decreased slightly*** from **June** to **July**, and then ***increased*** from **July** to **August**.

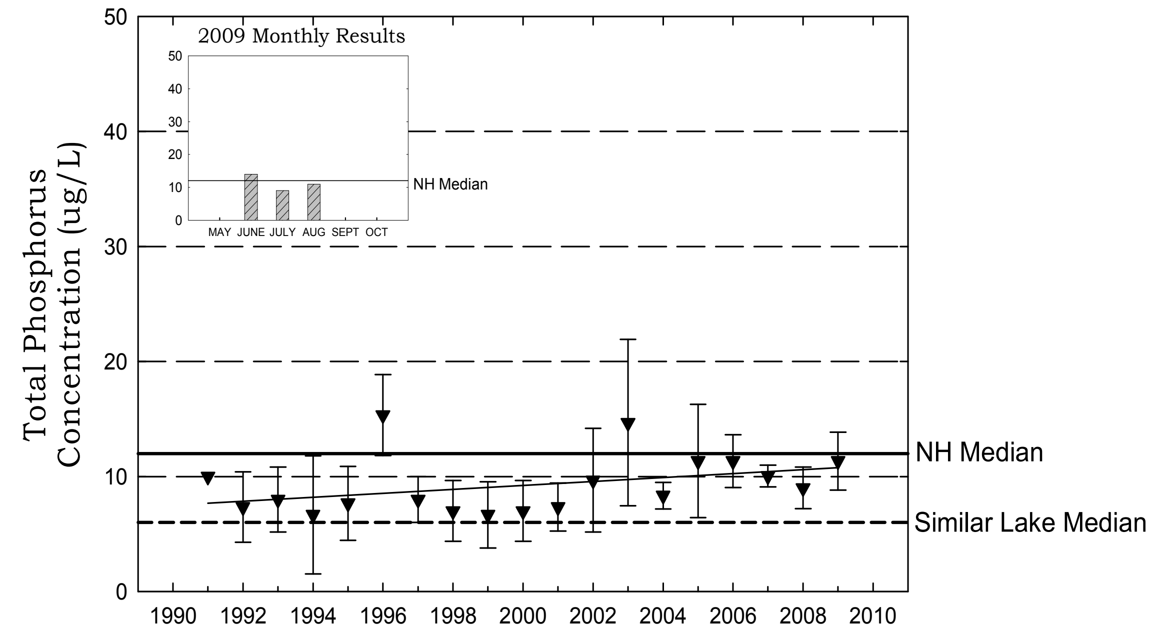
The historical data show that the **2009** mean hypolimnetic phosphorus concentration is ***slightly less than*** the state median and is ***slightly greater than*** the similar lake median. Please refer to Appendix D for more information about the similar lake median.

Overall, visual inspection of the epilimnetic and hypolimnetic historical data trend lines shows a ***relatively stable*** phosphorus trend since monitoring began. Specifically the mean annual epilimnetic and hypolimnetic phosphorus concentration has ***remained approximately the same*** since monitoring began in **1991**.

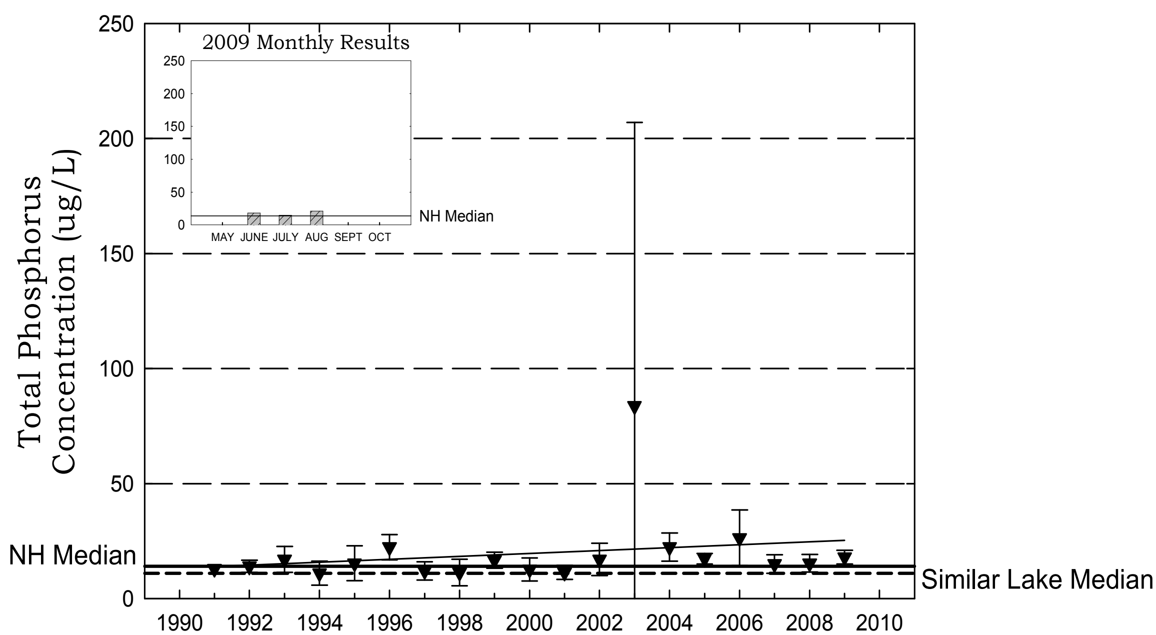
One of the most important approaches to reducing phosphorus loading to a waterbody is to continually educate watershed residents about the watershed sources of phosphorus and how excessive phosphorus loading can negatively affect the ecology and the recreational, economical, and ecological value of lakes and ponds.

Mascoma Lake, Stn. 1, Enfield

Figure 3. Monthly and Historical Total Phosphorus Data



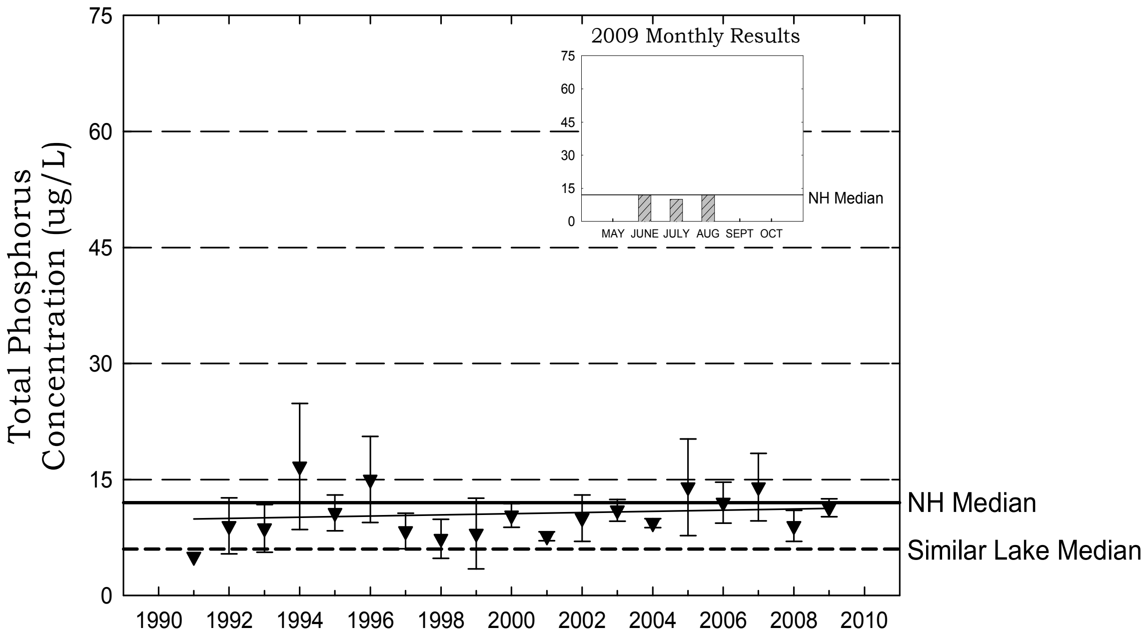
Epilimnion (Upper Water Layer)



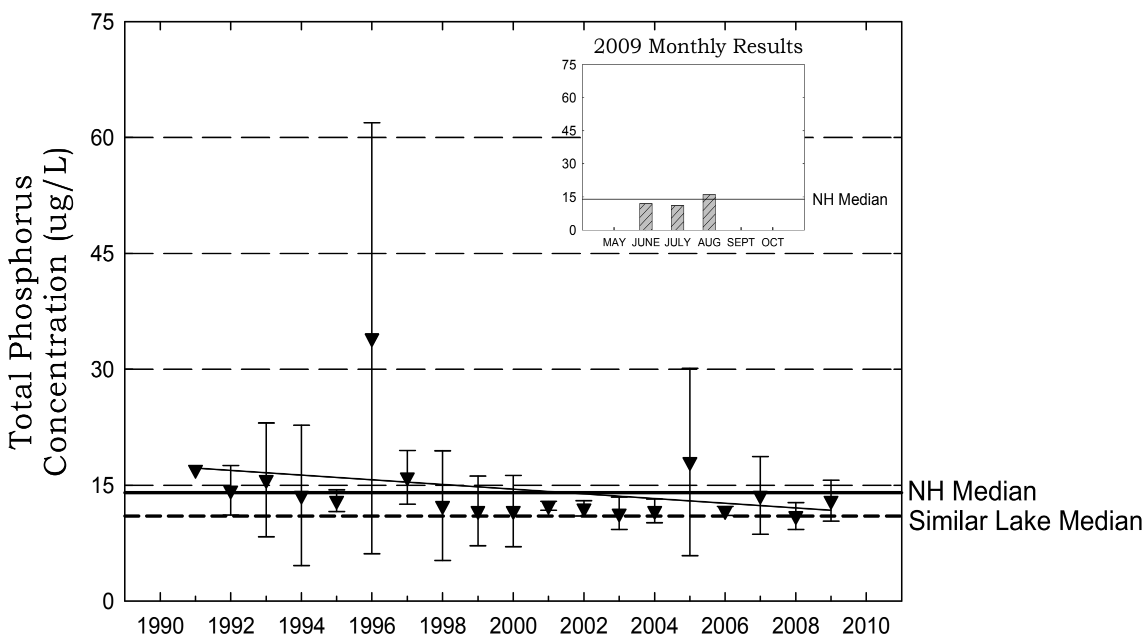
Hypolimnion (Lower Water Layer)

Mascoma Lake, Stn. 2, Enfield

Figure 3. Monthly and Historical Total Phosphorus Data



Epilimnion (Upper Water Layer)



Hypolimnion (Lower Water Layer)

➢ pH

Table 14 in Appendix A presents the current year pH data for the in-lake stations.

pH is measured on a logarithmic scale of 0 (acidic) to 14 (basic). pH is important to the survival and reproduction of fish and other aquatic life. A pH below 6.0 typically limits the growth and reproduction of fish. A pH between 6.0 and 7.0 is ideal for fish. The median pH value for the epilimnion (upper layer) in New Hampshire's lakes and ponds is **6.6**, which indicates that the state surface waters are slightly acidic. For a more detailed explanation regarding pH, please refer to the "Chemical Monitoring Parameters" section of this report.

The pH at the **Station 1** deep spot this year ranged from **6.90 to 7.10** in the epilimnion and from **6.22 to 6.24** in the hypolimnion. The pH at the **Station 2** deep spot this year ranged from **7.05 to 7.15** in the epilimnion and from **6.33 to 6.41** in the hypilimnion. This means that the epilimnions are ***approximately neutral***, and the hypolimnions are ***slightly acidic***.

It is important to point out that the hypolimnetic (lower layer) pH was ***lower (more acidic)*** than in the epilimnion (upper layer). This increase in acidity near the bottom is likely due to the decomposition of organic matter and the release of acidic by-products into the water column.

Due to the state's abundance of granite bedrock and acid deposition received from snowmelt, rainfall, and atmospheric particulates, there is little that can be feasibly done to effectively increase pond pH. The pH at the deep spot, however, is sufficient to support aquatic life.

➢ Acid Neutralizing Capacity (ANC)

Table 14 in Appendix A presents the current year epilimnetic ANC for the deep spot.

Buffering capacity (ANC) describes the ability of a solution to resist changes in pH by neutralizing the acidic input. The median ANC value for New Hampshire's lakes and ponds is **4.9 mg/L**, which indicates that many lakes and ponds in the state are at least "moderately vulnerable" to acidic inputs. For a more detailed explanation about ANC, please refer to the "Chemical Monitoring Parameters" section of this report.

The acid neutralizing capacity (ANC) of the **Station 1** and **Station 2** epilimnions (upper layer) ranged from **7.4 mg/L to 10.3 mg/L**. This indicates that the lake is ***moderately vulnerable*** to acidic inputs.

➢ Conductivity

Table 14 in Appendix A presents the current conductivity data for in-lake stations.

Conductivity is the numerical expression of the ability of water to carry an electric current, which is determined by the number of negatively charged ions from metals, salts, and minerals in the water column. The median conductivity value for New Hampshire's lakes and ponds is **40.0 uMhos/cm**. For a more detailed explanation, please refer to the "Chemical Monitoring Parameters" section of this report.

The **2009** conductivity results for the deep spot were ***lower than*** has been measured **during the past few years**.

The record rainfall during the **2009 summer season** possibly diluted the ion concentration in surface waters throughout the watershed. Specifically, the significant summer rainfalls likely increased the flushing rate for many lakes allowing potential watershed pollutants to flush through the system and not concentrate in the stratified surface waters.

However, the in-lake conductivity is ***slightly greater than*** the state median. Typically, elevated conductivity indicates the influence of pollutant sources associated with human activities. These sources include failed or marginally functioning septic systems, agricultural runoff, and road runoff which contains road salt during the spring snow-melt. New development in the watershed can alter runoff patterns and expose new soil and bedrock areas, which could also contribute to increasing conductivity. In addition, natural sources, such as iron and manganese deposits in bedrock, can influence conductivity.

It is likely that de-icing materials applied to nearby roadways during the winter months may be influencing the conductivity in the lake. In New Hampshire, the most commonly used de-icing material is salt (sodium chloride).

Therefore, we recommend that the **epilimnion** (upper layer) be sampled for chloride next year. This additional sampling may help us identify what areas of the watershed are contributing to the increasing in-lake conductivity.

Please note that the DES Limnology Center in Concord is able to conduct chloride analyses, free of charge. As a reminder, it is best to conduct chloride sampling in the spring as the snow is melting and during rain events.

➢ Dissolved Oxygen and Temperature

Table 9 in Appendix A depicts the dissolved oxygen/temperature profile(s) collected during **2009**.

The presence of sufficient amounts of dissolved oxygen in the water column is vital to fish and amphibians and also to bottom-dwelling organisms. Please refer to the "Chemical Monitoring Parameters" section of this report for a more detailed explanation.

STATIONS 1 AND 2
The dissolved oxygen concentration was ***greater than*** **100 percent** saturation between the **surface** and **three** meters at the **Station 1** deep spot, and between the **surface** and **two** meters at the **Station 2** deep spot on the **June** sampling event. The dissolved oxygen concentration was also ***greater than*** **100 percent** saturation between the **surface** and **two** meters at the **Station 2** deep spot on the **August** sampling event. Layers of algae can increase the dissolved oxygen concentration in the water column since oxygen is a by-product of photosynthesis. Wave action from wind can also dissolve atmospheric oxygen into the upper layers of the water column. Considering that the weather conditions on **6/30/2009** were very windy, we suspect that wave action contributed to the oxygen super-saturation. Considering the cyanobacteria concentrations were elevated in August, we suspect that a layer of cyanobacteria in the epilimnion caused the oxygen super-saturation.

The dissolved oxygen concentration was ***slightly lower in the hypolimnion (lower layer) than in the epilimnion (upper layer)*** at the deep spot on the **June, July and August** sampling events. As stratified lakes age, and as the summer progresses, oxygen typically becomes ***depleted*** in the hypolimnion by the process of decomposition. Specifically, the reduction of hypolimnetic oxygen is primarily a result of biological organisms using oxygen to break down organic matter, both in the water column and particularly at the bottom of the lake where the water meets the sediment. When the hypolimnetic oxygen concentration is depleted to less than 1 mg/L, the phosphorus that is normally bound up in the sediment may be re-released into the water column, a process referred to as ***internal phosphorus loading***.

➢ Turbidity

Table 14 in Appendix A presents the current year data for in-lake turbidity.

Turbidity in the water is caused by suspended matter, such as clay, silt, and algae. Water clarity is strongly influenced by turbidity. Please refer to the "Other Monitoring Parameters" section of this report for a more detailed explanation.

The turbidity of the **Station 2** epilimnion (upper layer) sample was ***slightly elevated*** (**2.11 NTUs**) on the **8/18/2009** sampling event. A cyanobacteria bloom was noted in the lake on **8/12/2009**. It is likely that an abundance of cyanobacteria cells in the epilimnion caused the elevated turbidity level.

TRIBUTARY SAMPLING

➢ Total Phosphorus

Table 14 in Appendix A presents the current year total phosphorus data for tributary stations. Please refer to the "Chemical Monitoring Parameters" section of the report for a detailed explanation of total phosphorus.

The phosphorus concentration in the **Browns Brook** sample on the **June, July and August** sampling events was ***elevated*** **(43, 20 and 39 ug/L)**, however, the turbidity was ***not elevated*** **(1.01, 0.88 and 0.94 NTUs)**.

Record summer rainfall likely increased stormwater runoff and nutrient loading to the tributary. As impervious surface cover increases in the watershed, stormwater runoff volumes increase. This transports phosphorus-laden stormwater into tributaries and eventually the lake. We recommend conducting a tributary survey to determine the source(s) of elevated phosphorus.

The phosphorus concentration in the **Canaan Canoe Launch, Dulacs Brook, Knox River Inlet, Mascoma River Inlet, McConnell Rd, Patten Bridge, Red Barn Bridge, Rt 4 A Bridge, and Shaker Brook** samples on the **June** sampling event were ***elevated***, and the turbidities were also ***elevated***. Elevated turbidity levels are most often a result of sediment and/or organic material present in the sample. These materials typically contain attached phosphorus and when present in elevated amounts contribute to elevated tributary phosphorus levels.

It had rained approximately **1.5 inches** during the **24-72 hours** prior to the **June** sampling event. Rain events typically carry phosphorus laden watershed runoff to tributaries. Phosphorus sources in the watershed can include agricultural runoff, failing or marginal septic systems, stormwater runoff, road runoff, and watershed development. Efforts should be made in the watershed to reduce impervious surfaces and limit phosphorus sources such as fertilizer use, septic influences, agricultural impacts, and sediment/erosion control.

➢ pH

Table 14 in Appendix A presents the current year pH data for the tributary stations. Please refer to the "Chemical Monitoring Parameters" section of this report for a more detailed explanation of pH.

The pH of **4A Lebanon Brook, Browns Brook, Canaan Canoe Launch, Dulacs Brook, McConnell Rd, and Patten Bridge** ranged from **6.36 to 6.89 (> 6)** and is sufficient to support aquatic life.

The pH of the **Dam Outlet, Knox River Inlet, LaSalette Brook, Mascoma River Inlet, Red Barn Bridge, Rt 4A Bridge, Shaker Brook, Smith Pond Brook, and Sucker Brook** appears to be slightly basic or alkaline (pH > 7).

This may naturally occur as a result of calcium rich bedrock. As carbon rich water percolates through the soil it can dissolve limestone in rock formations causing a natural increase in pH.

➢ Conductivity

Table 14 in Appendix A presents the current conductivity data for the tributary stations. Please refer to the "Chemical Monitoring Parameters" section of the report for a more detailed explanation of conductivity.

Browns Brook, Shaker Brook, Knox River Inlet, Sucker Brook, and Red Barn Bridge experienced elevated conductivity levels this season, and have experienced elevated or fluctuating conductivity since monitoring began. We recommend that your monitoring group conduct a conductivity survey of tributaries with ***elevated*** conductivity and along the shoreline of the pond to help identify the sources of conductivity. As previously mentioned increasing conductivity typically indicates the influence of pollutant sources associated with human activities.

For a detailed explanation on how to conduct rain event sampling and stream surveys, please refer to the 2002 VLAP Annual Report special topic article, which is posted on the VLAP website at ***http://www.des.nh.gov/organization/divisions/water/wmb/vlap/categories/publications.htm****, or contact the VLAP Coordinator.*

It is possible that de-icing materials applied to nearby roadways during the winter months may be influencing the conductivity in the tributaries. In New Hampshire, the most commonly used de-icing material is salt (sodium chloride).

Therefore, we recommend that the **tributaries** be sampled for chloride next year. This additional sampling may help us identify what areas of the watershed are contributing to the increasing in-lake conductivity.

Please note that the DES Limnology Center in Concord is able to conduct chloride analyses, free of charge. As a reminder, it is best to conduct chloride sampling in the spring as the snow is melting and during rain events.

McConnell Rd has experienced decreasing conductivity levels since monitoring began in 2004. **Mascoma River Inlet, LaSalette Brook and 4A Lebanon Brook** have experienced decreasing conductivity levels since 2005. **Dulacs Brook and Patten Bridge** experienced decreased conductivity levels in 2009.

The record rainfall during the **2009 summer season** (and in general since 2006) possibly diluted the ion concentration in surface waters throughout the watershed. Specifically, the significant summer rainfalls likely increased the flushing rate for many lakes and tributaries allowing potential watershed pollutants to flush through the system and not concentrate in the surface waters.

➢ Turbidity

Table 14 in Appendix A presents the current year turbidity data for the tributary stations. Please refer to the “Other Monitoring Parameters” section of the report for a more detailed explanation of turbidity.

The **4A Lebanon Brook, Canaan Canoe Launch, Dulacs Brook, Knox River Inlet, LaSalette Brook, Mascoma River Inlet, McConnell Rd, Patten Bridge, Red Barn Bridge, Rt 4A Bridge, and Shaker Brook** experienced turbid conditions in **June**, likely the result of stormwater runoff from significant rain events prior to sampling. Rainfall creates runoff that washes sediment and organic materials into tributaries causing turbid water conditions. Eventually, the suspended solids settle out once the flow is reduced or the tributary flow enters the lake.

These turbid conditions after a significant rain event indicate that erosion is occurring in the watershed. We recommend conducting a stream survey and additional rain event sampling to identify the source(s) of sedimentation to these tributaries.

The **Canaan Canoe Launch, Mascoma River Inlet, McConnell Rd, Patten Bridge, Shaker Brook, and Smith Pond** experienced turbid conditions in **July**. **Mascoma River Inlet, McConnell Rd and Patten Bridge** also experienced turbid conditions in **August**. The elevated turbidities were likely the result of low flow conditions. These conditions can lead bottom sediment contamination during sample collection. Please be careful to observe tributary flow conditions and only sample when sufficient flow is present.

➢ Bacteria (*E. coli*)

Table 14 in Appendix A lists the current year data for bacteria *(E.coli)* testing. *E. coli* is a normal bacterium found in the large intestine of humans and other warm-blooded animals. *E.coli* is used as an indicator organism because it is easily cultured and its presence in the water, in defined amounts, indicates that sewage **may** be present. If sewage is present in the water, potentially harmful disease-causing organisms **may** also be present. Please refer to the “Other Monitoring Parameters” section of the report for a more detailed explanation.

The **Knox River Inlet** *E. coli* concentration was ***elevated*** on the **June** sampling event. However, the **280** counts per 100 mL concentration ***was not greater than*** the state standard of 406 counts per 100 mL for recreational waters that are not designated public beaches.

If you are concerned about *E. coli* levels at this station, your monitoring group should conduct rain event sampling and bracket sampling in this area to determine the bacteria sources.

For a detailed explanation on how to conduct rain event sampling and stream *surveys, please refer to the 2002 VLAP Annual Report special topic article, which is posted on the VLAP website at* ***http://www.des.nh.gov/organization/divisions/water/wmb/vlap/categories/publications.htm****, or contact the VLAP Coordinator.*

The *E. coli* concentration in the **Mascoma River Inlet** sample was ***elevated*** on the **June** sampling event. The **> 2,000** counts per 100 mL concentration ***was greater than*** the state standard of 406 counts per 100 mL for recreational waters that are not designated public beaches.

We recommend that your monitoring group conduct rain event sampling and bracket sampling next year in this area. This additional sampling may help us determine the source of the bacteria.

For a detailed explanation on how to conduct rain event sampling and stream surveys, please refer to the 2002 VLAP Annual Report special topic article, which is posted on the VLAP website at ***http://www.des.nh.gov/organization/divisions/water/wmb/vlap/categories/publications.htm****, or contact the VLAP Coordinator.*

- **Chlorides**

Table 14 in Appendix A lists the current year data for chloride sampling. The chloride ion (Cl^-) is found naturally in some surface waters and groundwaters and in high concentrations in seawater. Research has shown that elevated chloride levels can be toxic to freshwater aquatic life. In order to protect freshwater aquatic life in New Hampshire, the state has adopted **acute and chronic** chloride criteria of **860 and 230 mg/L** respectively. The chloride content in New Hampshire lakes is naturally low, generally less than 2 mg/L in surface waters located in remote areas away from habitation. Higher values are generally associated with salted highways and, to a lesser extent, with septic inputs. Please refer to the "Chemical Monitoring Parameters" section of this report for a more detailed explanation.

Chloride sampling was **not** conducted during **2009**.

DATA QUALITY ASSURANCE AND CONTROL

Annual Assessment Audit

During the annual visit to your pond, the biologist conducted a sampling procedures assessment audit for your monitoring group. Specifically, the biologist observed the performance of your monitoring group while sampling and filled-out an assessment audit sheet to document the volunteer monitors' ability to follow the proper field sampling procedures, as outlined in the VLAP Monitor's Field Manual. This assessment is used to identify any aspects of sample collection in which volunteer monitors failed to follow proper procedures, and also provides an opportunity for the biologist to retrain the volunteer monitors as necessary. This will ultimately ensure that the samples volunteer monitors collect are truly representative of actual lake and tributary conditions.

Overall, your monitoring group did an ***excellent*** job collecting samples on the annual biologist visit this year! Specifically, the members of your monitoring group followed the proper field sampling procedures and there was no need for the biologist to provide additional training. Keep up the good work!

Sample Receipt Checklist

Each time your monitoring group dropped off samples at the laboratory this summer, the laboratory staff completed a sample receipt checklist to assess and document if your group followed proper sampling techniques when collecting the samples. The purpose of the sample receipt checklist is to minimize, and hopefully eliminate, improper sampling techniques.

Overall, the sample receipt checklist showed that your monitoring group did a ***very good*** job when collecting samples this year! Specifically, the members of your monitoring group followed the majority of the proper field sampling procedures when collecting and submitting samples to the laboratory. However, the laboratory did identify a few aspects of sample collection that your group could improve upon, as follows:

- **Sample labels:** On the **August** sampling event, at least one sample bottle was mis-labeled. However, by process of elimination or by contacting the volunteer monitors, it was possible for the laboratory staff to determine which sample bottles corresponded to what sampling locations. Please label your samples with a waterproof pen preferably by using a black permanent marker before sampling. If your association has made its own sample bottle labels, please fold over one corner of each label before placing it on a sample bottle so that the label will not become permanently attached to the bottle. In addition, please make sure that the labels will stick to the bottles when they are wet.

USEFUL RESOURCES

Best Management Practices to Control Nonpoint Source Pollution: A Guide for Citizens and Town Officials, DES Booklet WD-03-42, (603) 271-2975 or www.des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-03-42.pdf.

Cyanobacteria in New Hampshire Waters Potential Dangers of Blue-Green Algae Blooms, DES fact sheet WMB-10, (603) 271-2975 or www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-10.pdf.

Erosion Control for Construction in the Protected Shoreland Buffer Zone, DES fact sheet WD-SP-1, (603) 271-2975 or http://des.nh.gov/organization/commissioner/pip/factsheets/sp/documents/sp-1.pdf

How to Identify Cyanobacteria, DES Pamphlets & Brochures, (603) 271-2975 or http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/cyano_id_flyer.pdf

Low Impact Development Hydrologic Analysis. Manual prepared by Prince George's County, Maryland, Department of Environmental Resources. July 1999. To access this document, visit www.epa.gov/owow/nps/lid_hydr.pdf or call the EPA Water Resource Center at (202) 566-1736.

Low Impact Development: Taking Steps to Protect New Hampshire's Surface Waters, DES fact sheet WD-WMB-17, (603) 271-2975 or www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-17.pdf.

*NH Stormwater Management Manual Volume 1: Stormwater and Antidegradation, DES fact sheet WD-08-20A, (*603) 271-2975 or http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-08-20a.pdf

NH Stormwater Management Manual Volume 2: Post-Construction Best Management Practices Selection and Design, DES fact sheet WD-08-20B, *(*603) 271-2975 or http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-08-20b.pdf

NH Stormwater Management Manual Volume 3: Erosion and Sediment Controls During Construction, DES fact sheet WD-08-20C, *(*603) 271-2975 or http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-08-20c.pdf

Road Salt and Water Quality, DES fact sheet WD-WMB-4, (603) 271-2975 or www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-4.pdf.

Shorelands Under the Jurisdiction of the Comprehensive Shoreland Protection Act, DES fact sheet SP-4, (603) 271-2975 or http://des.nh.gov/organization/commissioner/pip/factsheets/sp/documents/sp-4.pdf.

Vegetation Maintenance Within the Protected Shoreland, DES fact sheet WD-SP-5, (603) 271-2975 or http://des.nh.gov/organization/commissioner/pip/factsheets/sp/documents/sp-5.pdf

Watershed Districts and Ordinances, DES fact sheet WD-WMB-16, (603) 271-2975 or www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-16.pdf.